

WHAT IS CLAIMED IS:

1. BaTiO_3 - PbTiO_3 series single crystal single-crystallized by heating BaTiO_3 - PbTiO_3 compact powder member or sintered member having a smaller Pb-

5 containing mol number than Ba-containing mol number, while keeping said powder or member in non-molten condition.

10 2. BaTiO_3 - PbTiO_3 series single crystal according to Claim 1, wherein the rearrangement density is 10^2 pieces/ cm^2 or more and 10^6 pieces/ cm^2 or less, and the ratio of pore content is within a range of 1 volume ppm or more and 5 volume % or less.

15 3. BaTiO_3 - PbTiO_3 series single crystal according to Claim 1, wherein the ratio of PbTiO_3 content is 45 mol % or less.

20 4. BaTiO_3 - PbTiO_3 series single crystal according to Claim 3, wherein the ratio of PbTiO_3 content is 30 mol % or less.

25 5. BaTiO_3 - PbTiO_3 series single crystal according to Claim 4, wherein the ratio of PbTiO_3 content is 25 mol % or less.

6. BaTiO_3 - PbTiO_3 series single crystal according

to Claim 1, wherein the volume of said single crystal is 1 mm³ or more.

7. A piezoelectric type actuator comprising:
5 a layer formed by BaTiO₃ - PbTiO₃ series single crystal according to Claim 1.

8. A liquid discharge head comprising:
the piezoelectric type actuator according to Claim
10 7.

9. BaTiO₃ - PbTiO₃ series single crystal having the rearrangement density of 10² pieces/cm² or more and 10⁶ pieces/cm² or less, and the ratio of pore content
15 being within in a range of 1 volume ppm or more and 5 volume % or less.

10. BaTiO₃ - PbTiO₃ series single crystal according to Claim 9, wherein the ratio of PbTiO₃
20 content is 45 mol % or less.

11. A piezoelectric type actuator comprising:
a layer formed by BaTiO₃ - PbTiO₃ series single crystal according to Claim 9.
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12. A liquid discharge head comprising:
the piezoelectric type actuator according to Claim

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13. A method for manufacturing BaTiO_3 - PbTiO_3
5 series single crystal comprising the following step of:
single-crystallizing BaTiO_3 - PbTiO_3 compact powder
member or sintered member having a smaller Pb-
containing mol number than Ba-containing mol number by
defining the range of the mol ratio of elements
10 contained therein to be $0.9800 < (\text{Ba} + \text{Pb}) / \text{Ti} <$
 1.0000 , and by heating, while keeping said powder or
member in non-molten condition.

14. A method for manufacturing BaTiO_3 - PbTiO_3
15 series single crystal according to Claim 13, wherein
the range of the mol ratio of elements contained in
said compact powder member or sintered member to be
 $0.9900 < (\text{Ba} + \text{Pb}) / \text{Ti} < 0.9999$.

15. A method for manufacturing BaTiO_3 - PbTiO_3
20 series single crystal according to Claim 14, wherein
the range of the mol ratio of elements contained in
said compact powder member or sintered member to be
 $0.9950 \leq (\text{Ba} + \text{Pb}) / \text{Ti} \leq 1.0000$.

25 16. A method for manufacturing BaTiO_3 - PbTiO_3
series single crystal according to Claim 13, wherein

the ratio of PbTiO_3 content in said compact powder member or said sintered member is 45 mol % or less.

5 17. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 16, wherein the ratio of PbTiO_3 content in said compact powder member or said sintered member is 30 mol % or less.

10 18. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 17, wherein the ratio of PbTiO_3 content in said compact powder member or said sintered member is 25 mol % or less.

15 19. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 13, comprising the following step of:

single-crystallizing by heating said compact powder member or sintered member within a temperature
20 range of 1,200°C or more and 1,400°C or less.

25 20. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 13, wherein a compound containing lead is inserted into a furnace during the single crystal growing process to generate steam containing Pb for the growth of BaTiO_3 - PbTiO_3 series single crystal.

21. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 13, comprising the following step of:

5 single-crystallizing by heating, while keeping said compact powder member or sintered member in the lead atmosphere and in non-molten condition.

10 22. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal, comprising the following steps of:

preparing BaTiO_3 series single crystal or BaTiO_3 - PbTiO_3 series single crystal as seed crystal;

15 coupling BaTiO_3 - PbTiO_3 series sintered member composed of crystal grain of average granular diameter of 20 μm or less, having the relative density of 95% or more, with the {100} plane, {110} plane, or {111} plane of said seed crystal; and

20 single-crystallizing by heating, while keeping said coupled substance in non-molten condition.

23. A method for manufacturing BaTiO_3 - PbTiO_3 series single crystal according to Claim 20, wherein the mol ratio of elements contained in said BaTiO_3 - PbTiO_3 series sintered member is within a range of
25 $0.9950 \leq (\text{Ba} + \text{Pb}) / \text{Ti} \leq 0.9999$.

24. A method for manufacturing BaTiO_3 - PbTiO_3

series single crystal according to Claim 22, wherein a compound containing lead is inserted into a furnace during the single crystal growing process to generate steam containing Pb for the growth of BaTiO_3 - PbTiO_3 series single crystal.

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